Image Dataset Curation and Art Recommendation

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January 2024

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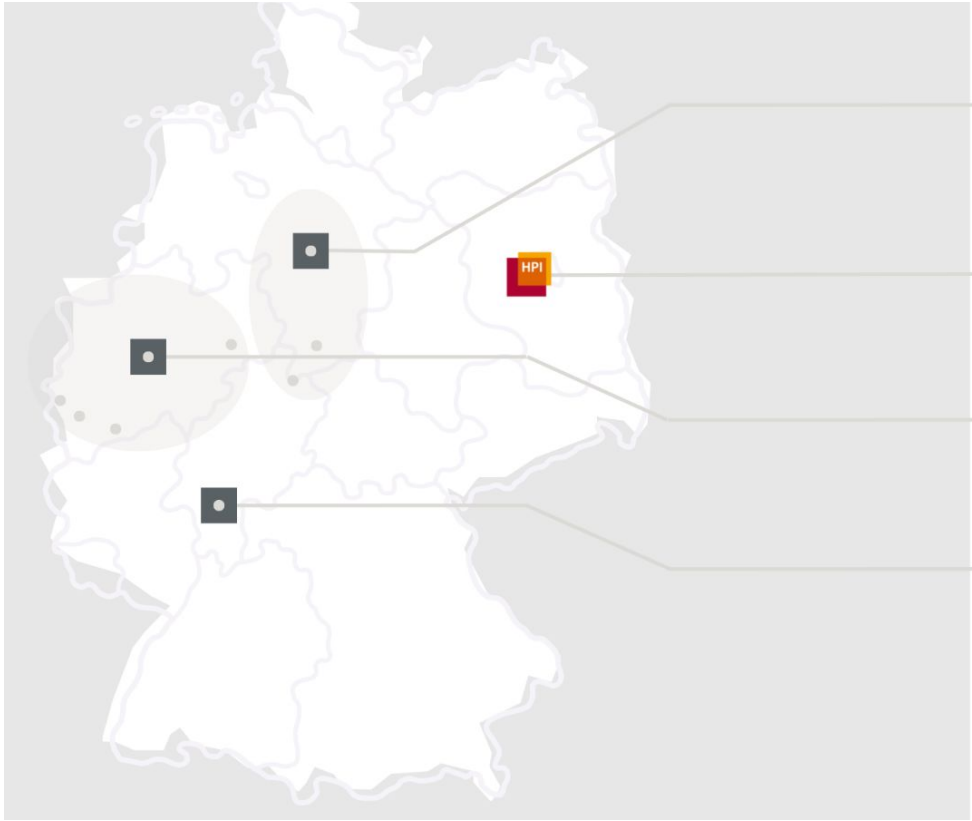
https://hpi.de/kisz/home.html



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Dortmund I Bonn I Jülich I Aachen I Paderborn
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Agenda

- Brief intro and learning objectives
- Use cases for image similarity
- Understanding image embeddings
- Scraping images from Google Images or Bing
- Setting up Google Colab and Drive
- Using pre-trained networks for image similarity
- Visualizing embeddings with TensorBoard
- Review questions and discussion

What we expect you to have

- Some Python knowledge
- Curiosity :)

Learning objectives

At the end of the first workshop you will be able to:

- Describe use cases for image similarity in dataset curation
- Scrape images from Google Images or Bing
- Generate embeddings for images using a pretrained neural network
- Compare image pairs using cosine similarity
- Visualize embeddings in 3D using Tensorboard

Learning objectives

At the end of the second workshop you will be able to:

- Visualize image neighborhoods with k-nn
- Cluster images using k-medoids
- Select representative images
- Classify images using a pre-trained Resnet
- Run zero-shot classification with CLIP

How are we doing this workshop

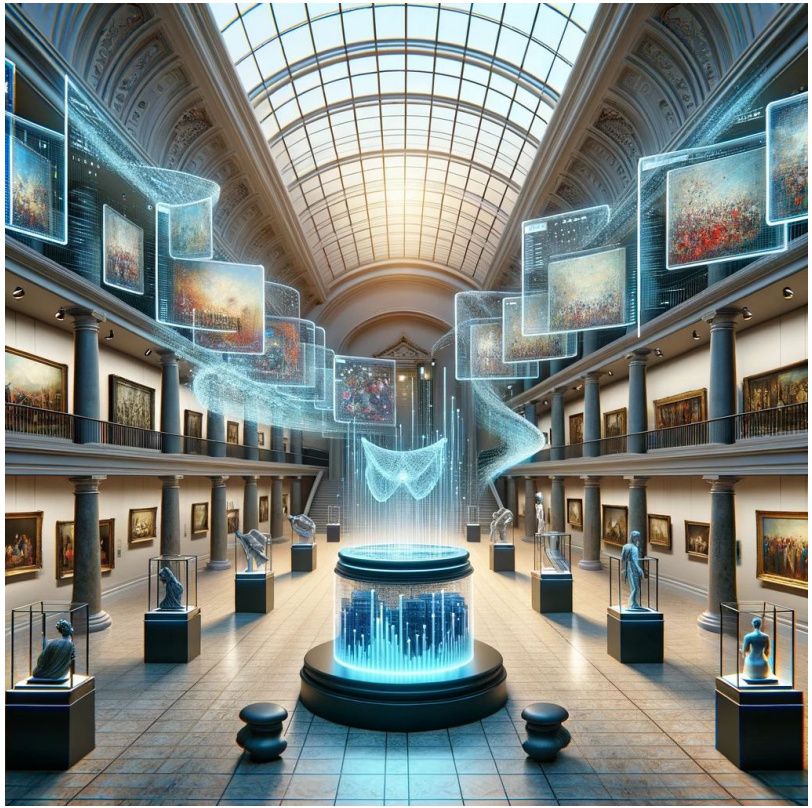
- We **type** most of the Python code from the tutorial notebooks in Google Colab

Repository:https://github.com/KISZ-BB/image-dataset-curation-workshops

What you need

- A Google user account
- A Google Drive account with enough free space
- Google Chrome or Firefox

What is dataset curation?

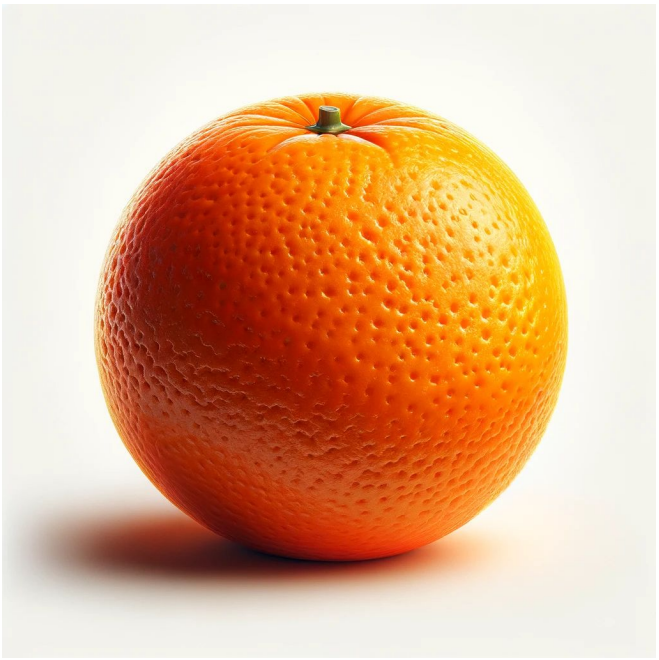


- We want to make data **accurate** and **relevant**
- We clean, deduplicate, and label
- This is similar to what museum curators do

How similar are these two images?

Cosine similarity = 0.91

How similar are these two images?



Cosine similarity = 0.78

How similar are these two images?

Cosine similarity = 0.53

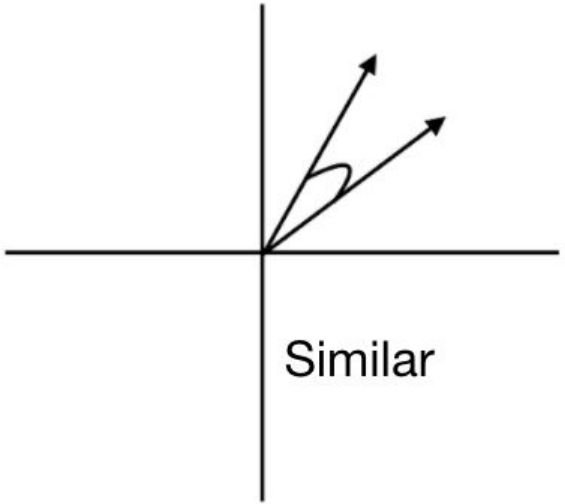
How similar are these two images?

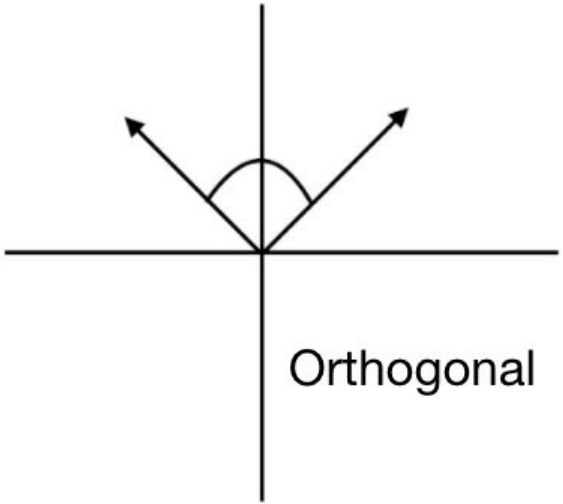
Cosine similarity = 0.65

How similar are these two images?

Cosine similarity = 0.84

Cosine Similarity



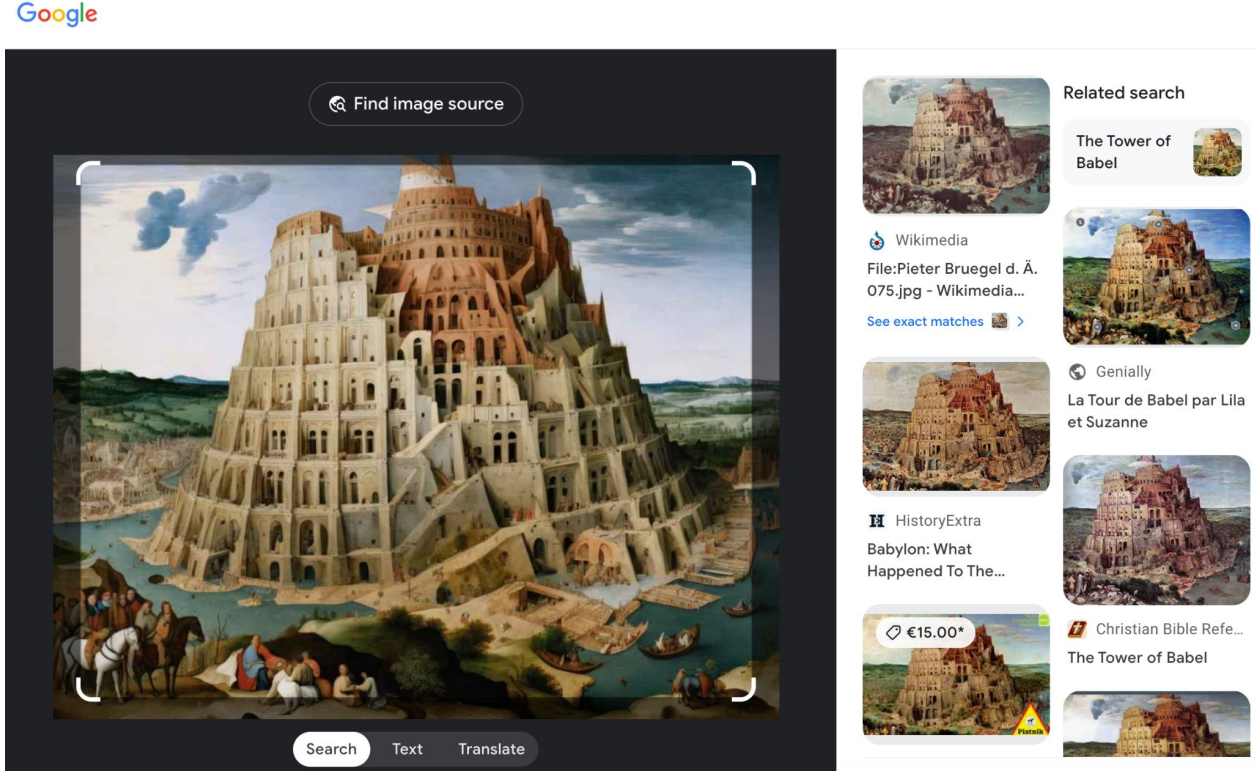


$$\text{similarity} = \cos(\theta) = \frac{\mathbf{A} \cdot \mathbf{B}}{\|\mathbf{A}\|\|\mathbf{B}\|}$$

Time for the first notebook

Comparing apples to apples

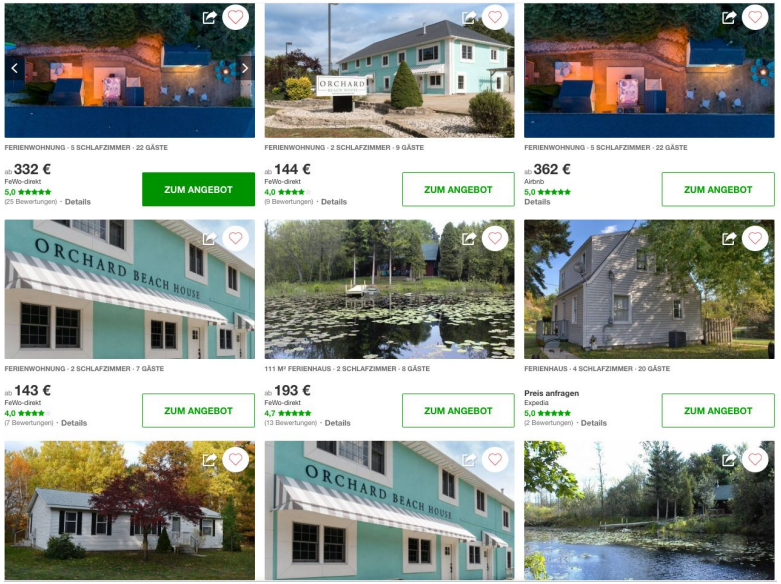
Use Case: Google’s reverse image search

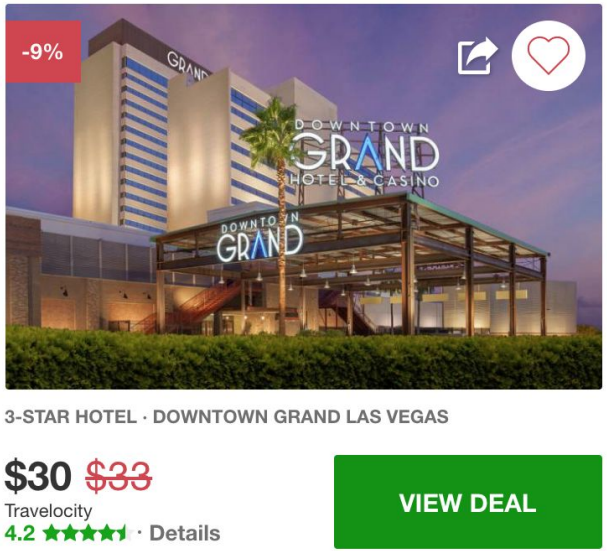


https://images.google.com/

Use case: image matching at hometogo.com

- Inventory understanding (500 million images)
- Providing the best deals to users (sample use case: strike prices)





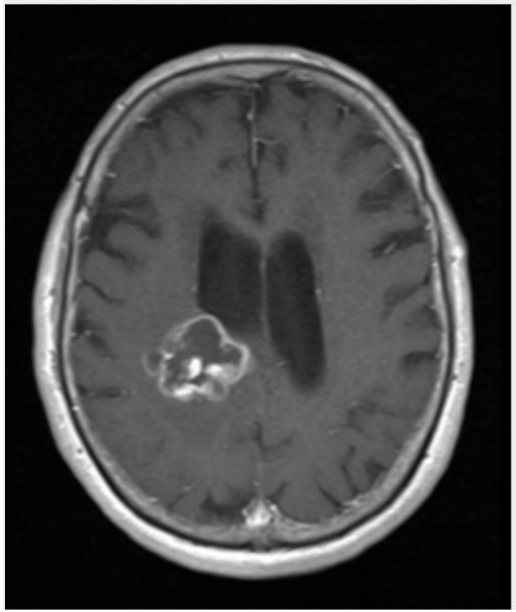
Use case: primary image matching at Hometogo

Cosine similarity = 0.65

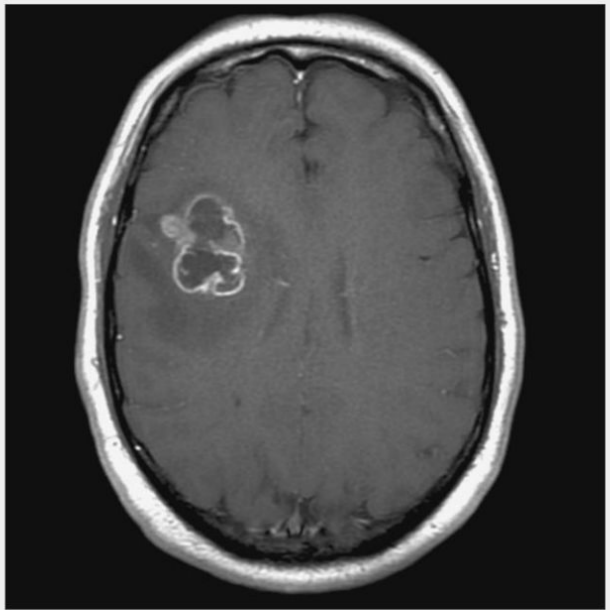
Use case: primary image matching at Hometogo

Cosine similarity = 0.99

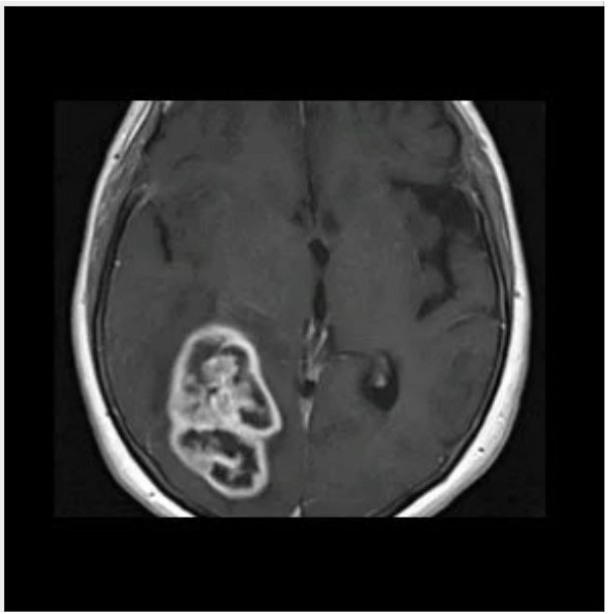
Use case: differential diagnosis



Glioma grade I



Glioma grade I



Glioma grade III

https://github.com/pixel-diagnose/pixel-diagnose

Use case: bike trip routing

Cluster 0: Safe bike lanes




Cluster 1: Unsafe bike lanes




Use case: bike trip routing

www.github.com/graumannm/Berlin_Bike_CV

Use case: cleaning image datasets

https://github.com/cleanlab/cleanlab

README.md

Art Recommendation system

This is the repository of a portfolio project at DSR. This project aims to identify similar images using pre-trained computer vision networks. For an explanation of the technology see the technology section.

Contributors

- Catarina Ferreira
- Gargi Maheshwari

https://github.com/gargimaheshwari/Wikiart-similar-art

Motivation: enhancing Wikiart's recommendations

The Painter and the Art Lover - Pieter Bruegel the Elder

Pieter Bruegel the Elder

Pieter Brueghel de Oude

Born: c.1525; Breda, Netherlands

Died: September 9, 1569; Brussels, Belgium

Nationality: Flemish

Art Movement: Northern Renaissance

Painting School: Flemish School, Antwerp School

Genre: genre painting

Field: painting, printmaking

Influenced by: Hieronymus Bosch

Influenced on: Tobias Verhaecht, Peter Paul Rubens, Jan Miense Molenaer, Hendrick Avercamp

Art institution: Guild of Saint Luke

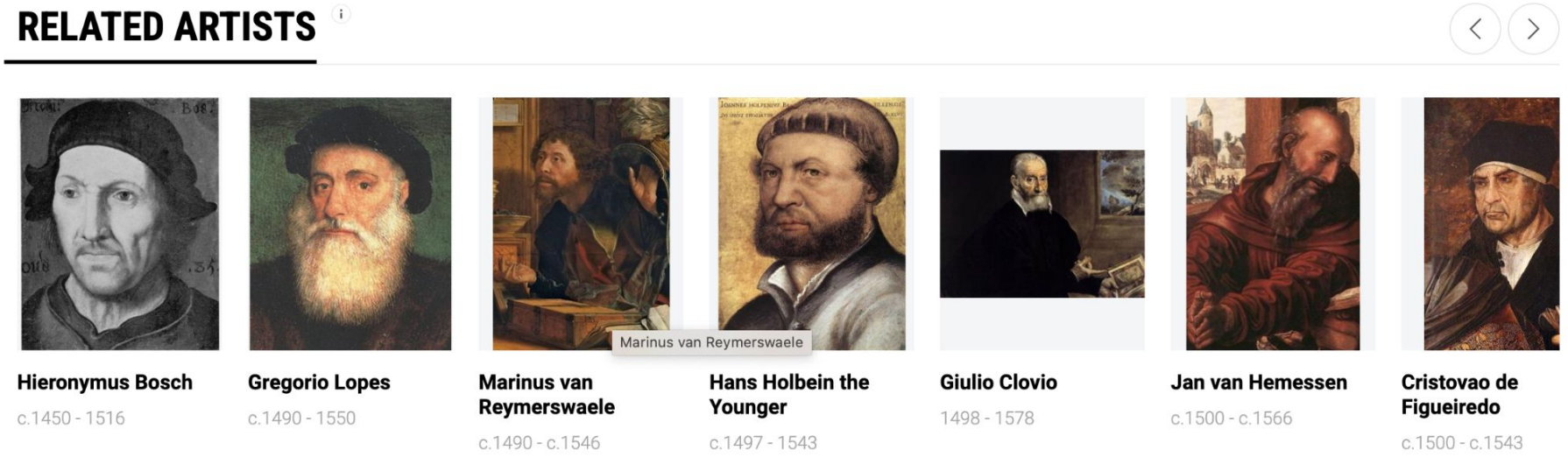
Friends and Co-workers: Maarten de Vos, Giulio Clovio

Family and Relatives: Jan Brueghel the Elder, Pieter Brueghel the Younger

Wikipedia: en.wikipedia.org/wiki/Pieter_Bruege...

https://www.wikiart.org/en/pieter-bruegel-the-elder

Motivation: improving Wikiart's art recommendation



https://www.wikiart.org/en/pieter-bruegel-the-elder

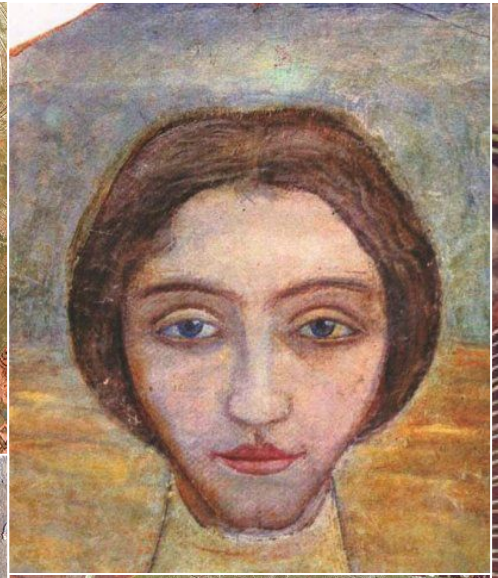
Motivation: improving Wikiart's art recommendation

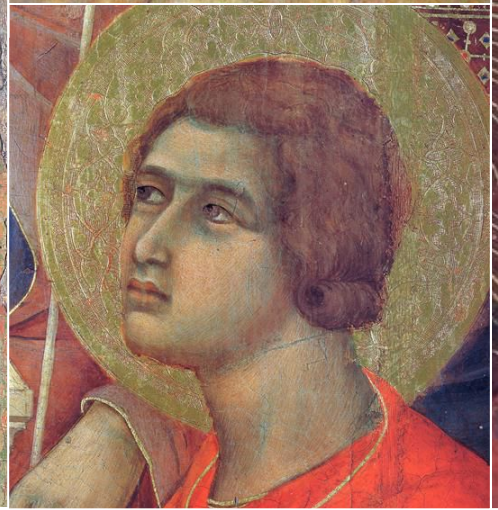
ARTISTS BY ART MOVEMENT

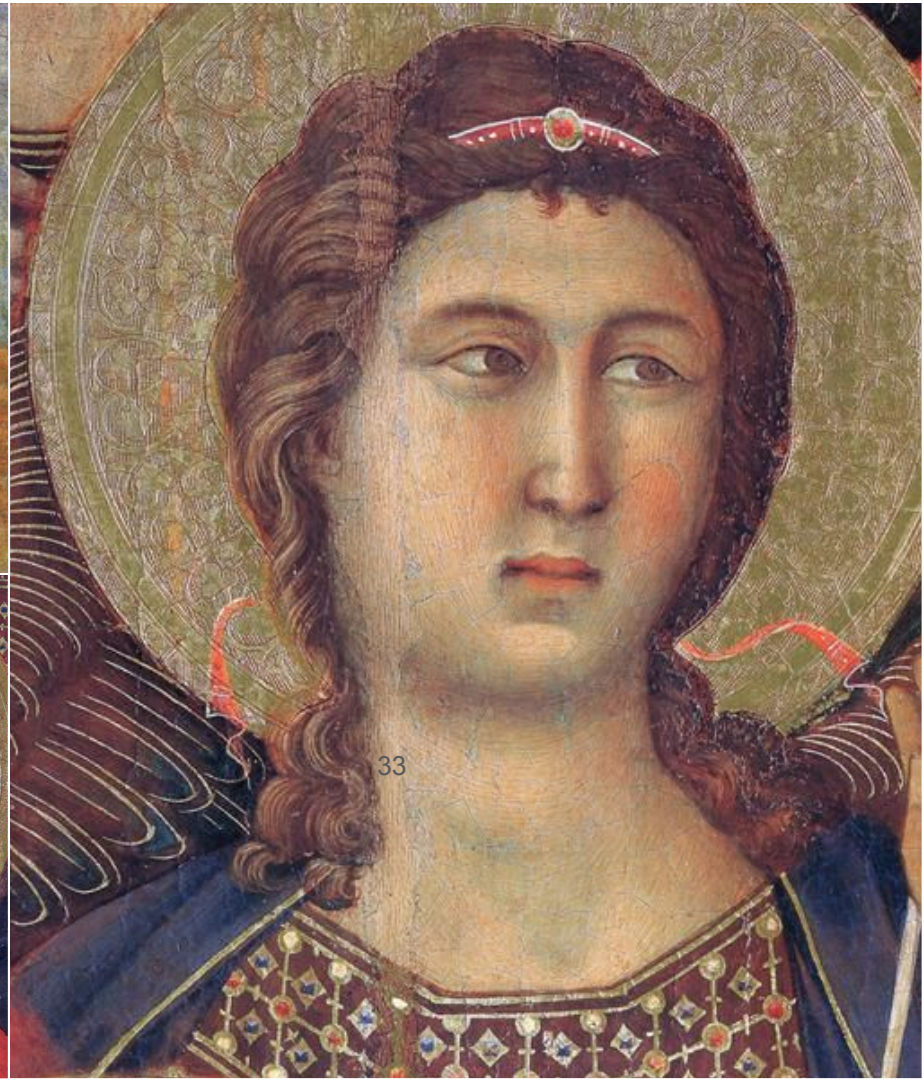
Art historians employ a number of ways to group world arts into systems of classification. They subdivide the continuous flow of artworks through time and space into groupings. These groupings are defined by the perception that the artworks within them share a single quality or a set of qualities that are significant. Significant qualities reflect a specific approach of an artist; they can include the formal, stylistic, iconographic, thematic, or other aspects of art. The definition of a grouping reflects judgments about the nature of meaningful connections between artworks, and between art and its larger context. Western arts are usually structured by art movements, using mostly cultural and aesthetic criteria, while Eastern arts are subdivided into periods according to political-dynastic markers.

by time | by name | by count

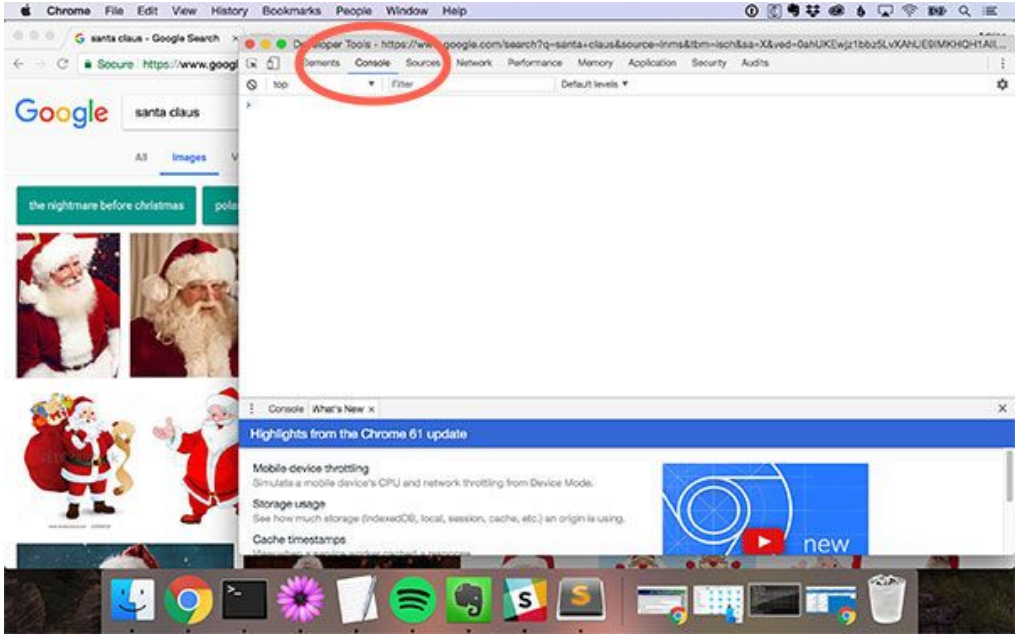

12.8.1945





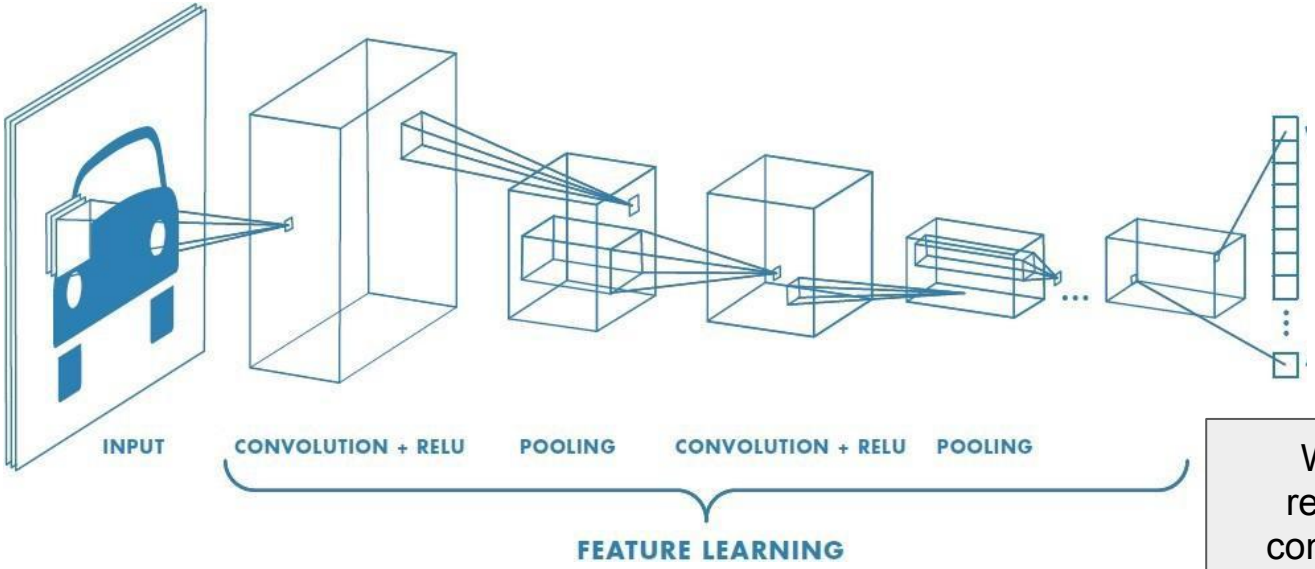


Scraping a dataset from Google Images



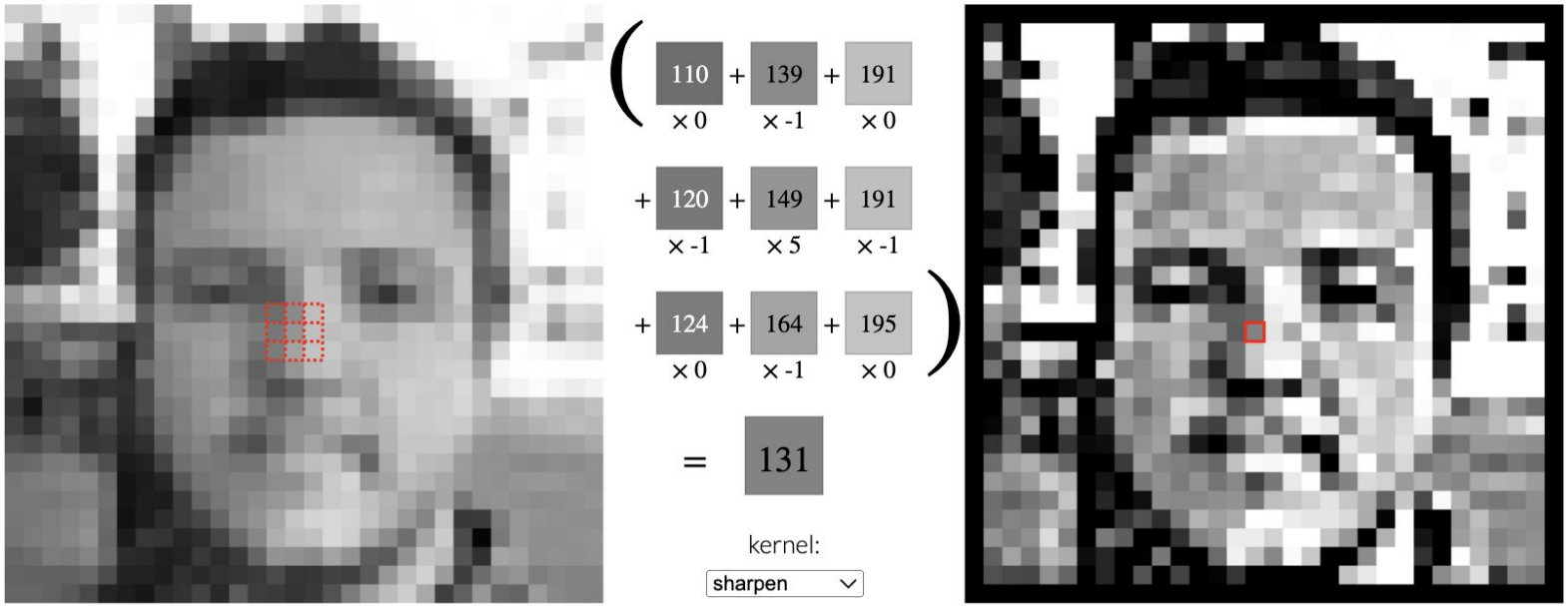
[PyImageSearch guide]

Image Embeddings from Convolutional Networks



We use the flattened representation from all convolutions and pooling

Intuitions about convolutions



https://setosa.io/ev/image-kernels/

The ImageNet dataset

https://www.image-net.org/

Visualizing embeddings in TensorBoard

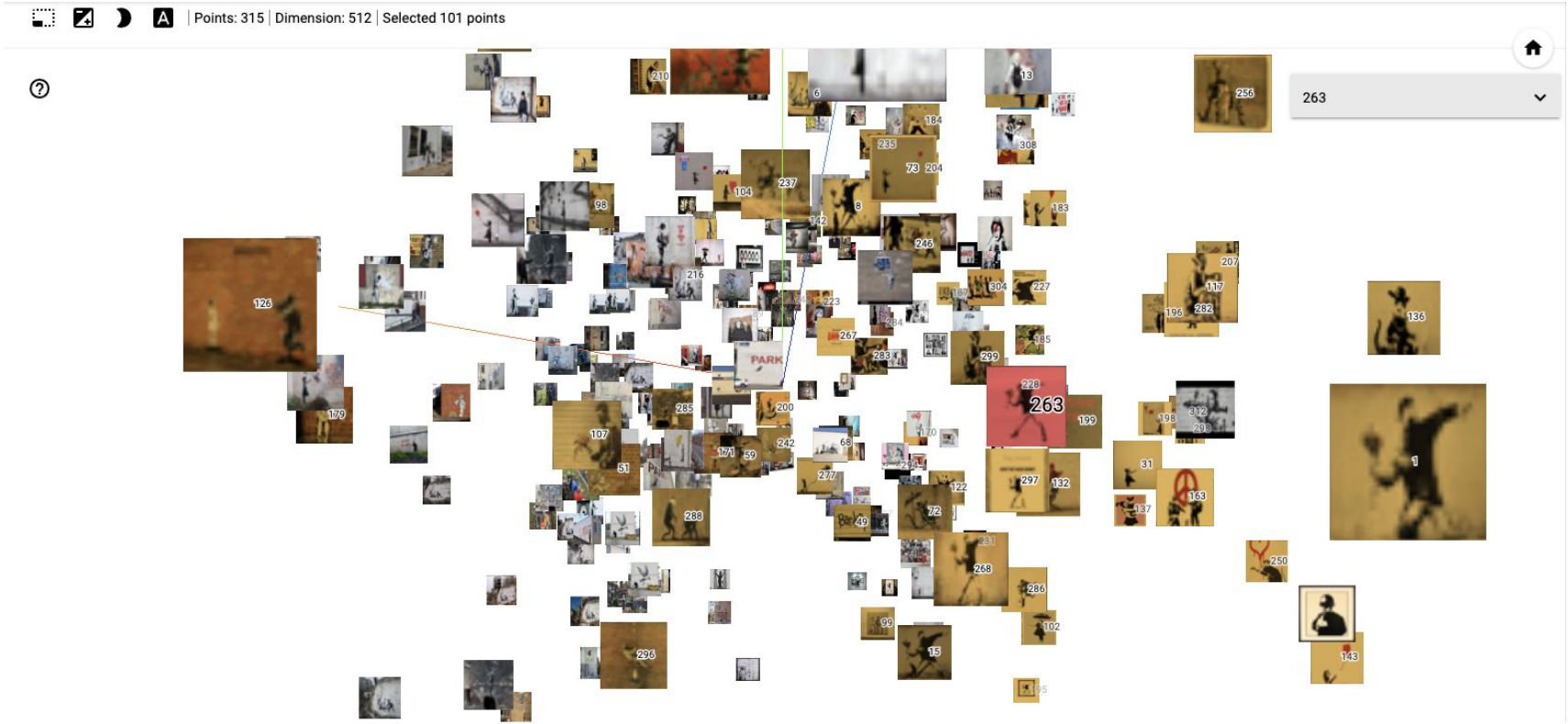


Image neighborhoods

1.0

0.73

0.73

0.72

0.7

0.7

Review questions

- How can we access an image array from its file's url?
- What is an embedding?
- What is maximum possible value of cosine similarity between two vectors?
- What's the cosine similarity between two orthogonal vectors?
- What is Imagenet?
- Would changing the Resnet change the cosine similarity that we obtain from an image pair?

Join us for the next workshops!

- AI Service Center - Berlin Brandenburg

Next topics:

- **Image clustering**
- **Fine tuning models for image classification**
- **Image analysis with CLIP**
- **Meta’s Segment Anything**
- **Segmentation and object detection with Detectron2**
- **Using Qdrant as a vector database for images**
- **Deployment of recommendation system with FastAPI and Docker**